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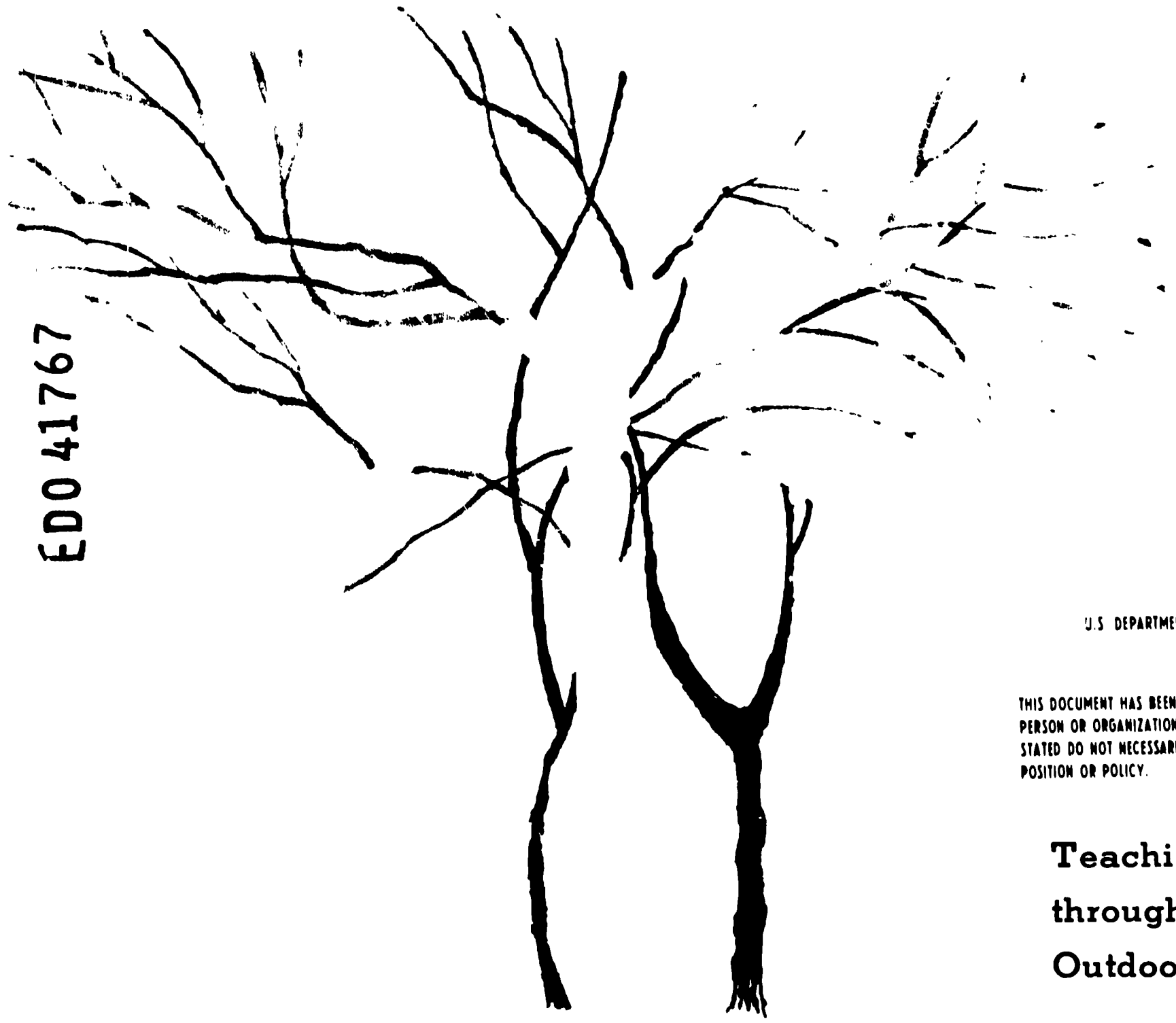
ABSTRACT

This guide is for teachers (K-12) interested in developing and using outdoor education areas. Student participation is presented as the key to a successful program. A discussion of what can be done by outdoor education programs is presented. The guide suggests sites to be chosen in terms of accessability, size, attractiveness, safety, drinking water, and sanitary facilities. Trails are to be developed on these sites with zones for distinctive site features or special areas. Station signs developed on these trails are separated into three types (1) identification writeups, (2) station writeups, (3) special area writeups. Each type of station writeup is explained and illustrated with examples. A special bibliography is included on the development and use of outdoor education areas. (BB)



Teaching Conservation through Outdoor Education Areas

U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE PA-837

CONTENTS

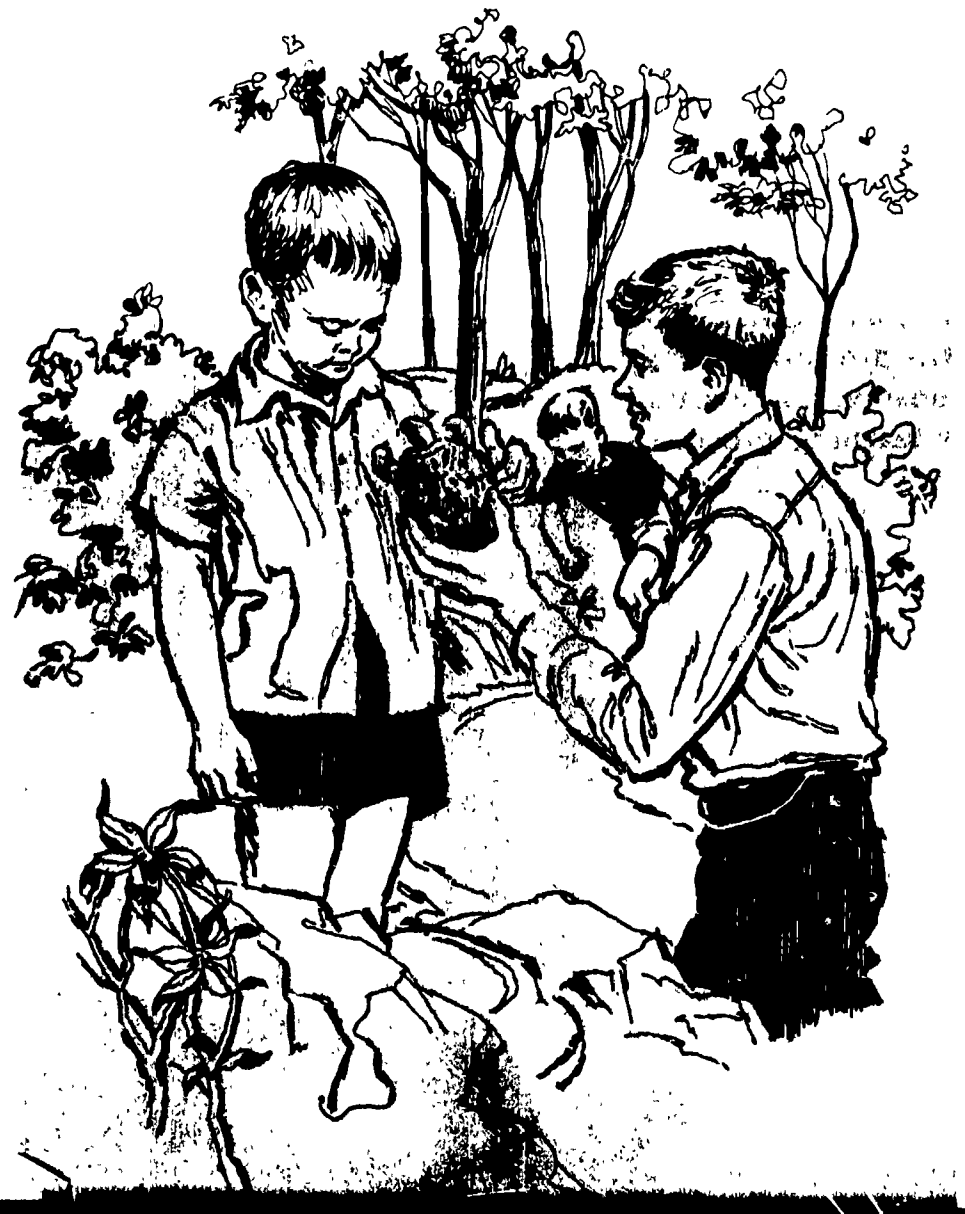
ISSUED JULY 1968

OUTDOOR EDUCATION AREAS

The Need for Conservation Education. Conservation education has grown out of a public need for a better understanding of wise resource use. With the rapid population increase and the desire for continued higher standards of living, the demand on all natural resources has been constantly growing. To protect the future of our national economy and to make resources serve man's needs more effectively, a sound program of education in wise use must be developed.

Progress has been made in some parts of the Nation. Many good local and some State-wide conservation education programs have been instituted. But often such efforts have been scattered and there has been too little attempt to coordinate the endeavors of the many conservation and education groups.

A great deal has been and is being written about conservation education—what should be taught and how it should be taught—who should teach it and where it should be taught. On a few things there is general agreement. A fundamental agreement is that conservation *needs* to be taught. It is also agreed that any plan of education should use the contributions that can be made to the program by State, federal, and private agencies. Conservation education, it is assumed, is a function of the elementary and secondary schools, and should be particularly emphasized in the former. Since most attitudes and behavioral patterns are formed early in youth, it is important that conservation learning take its place along with other learning processes.



Conservation education offers a fine opportunity for introducing more firsthand experience into the curriculum. Educators widely agree that this needs to be done, for participation is the key to true learning. Dr. Seaman A. Knapp, father of the successful Farm Demonstration Method of Teaching, summed it up this way,

> What a man hears, he may doubt,
> What a man sees, he may possibly doubt,
> What a man does himself, he cannot doubt.

In many school subjects firsthand experience is difficult to provide. But conservation can easily provide it. A class need go no farther than its own schoolground to find a field laboratory in conservation if the teacher knows how to use it.

However, we are attempting to teach the *total environment*—the total relationship between man and the world around him. Why? Because we believe that man can live in harmony with the land, provided he has knowledge of his world, the interrelated factors that determine his use of its resources, and an understanding of the importance of his own role in the world's future.

One of the best places to develop this concept is on a National Forest. Here there are excellent opportunities to develop nature study areas, conservation demonstration areas, or outdoor laboratories. If only one such area were developed on each U.S. Forest Service Ranger District, we would have 817 conservation education areas, and an excellent means toward providing real life experiences in learning activities.

Dr. D. Willard Zahn, Dean Emeritus, School of Education, Temple University, calls the outdoors the "Laboratory of Living", and says it offers "multi-sensory stimuli which can be carried into the classrooms". There is no richer learning environment than the realm of nature. It is important to provide it for each child, now that towns and cities are pushing nature farther away. Conservation demonstration areas should be established not only on National Forests, but on other Federal lands, State, county, municipal, and private lands.

Develop a sound conservation philosophy. The building of proper conservation attitudes and an ecological approach are perhaps the greatest values of an outdoor education area. With such an approach and a better understanding comes respect for nature—the very foundation of conservation.

Increase the effectiveness of teaching natural resource conservation.

The conservation of resources is one of the major problems that we, as a Nation, face today. Human life is impossible without natural resources. To live well we must have an abundance of them, and to continue to have an abundance depends upon their wise use. Resource-use education is the heart of all education.

Blend economics with esthetics, and natural beauty with practicality.

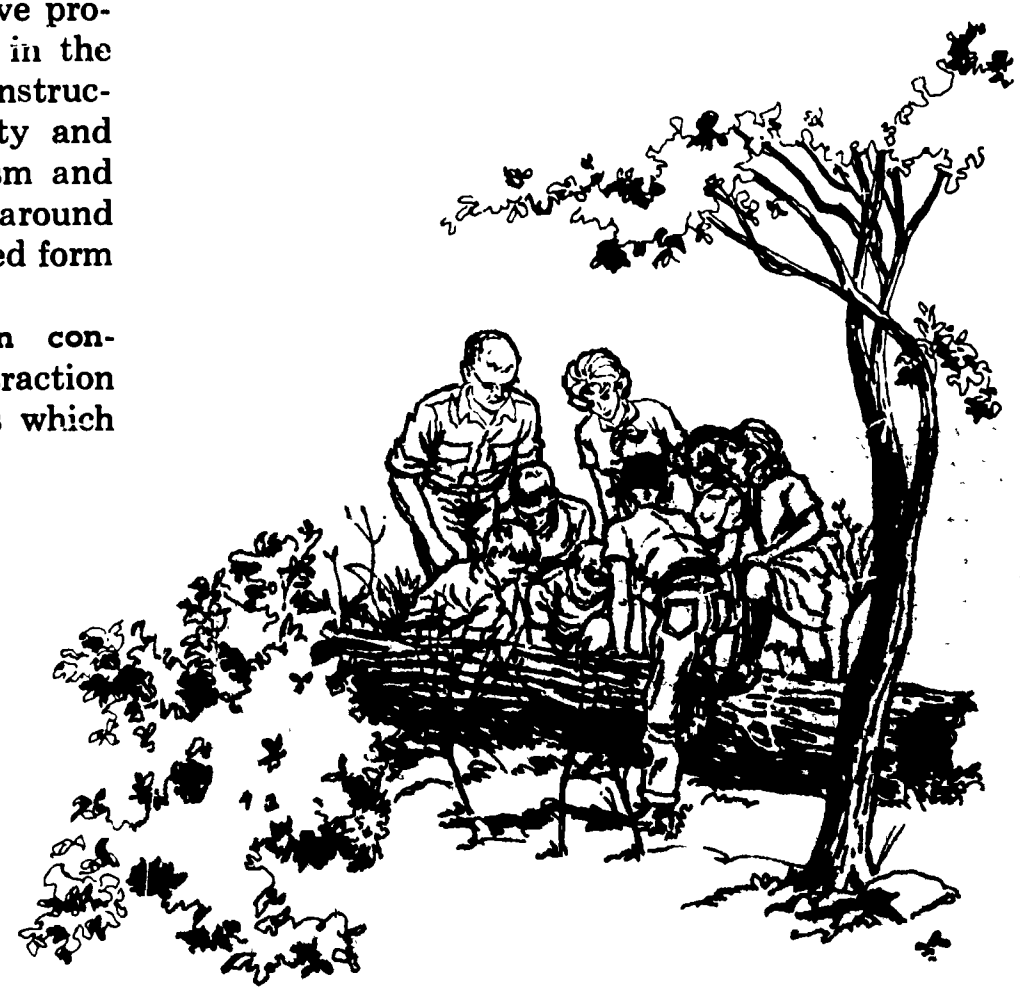
This is in line with the national policy, which calls for a New Conservation, and a greater effort to sustain an environment suitable for man.

Provide the experience of observing, not just seeing.

John Burroughs said, "We see but we do not observe". Opportunity should be provided to employ every sense in experiencing nature. One doesn't just *see* a forest; one should *listen* to a forest, and *smell* a forest, *feel* a forest, and even *taste* it. Each sense impression complements the other, providing a many-faceted unique experience that each child will remember because he made each test himself. This will stimulate his interest.

Liberate curiosity . . . A child is innately curious about many things. This is good, and he should be encouraged to ask "why". An imaginative program will expose many wonders that exist in the world. An objective of this kind of outdoor instruction is to liberate the individual's curiosity and exploring instinct, and foster his enthusiasm and concern about many things in the world around him. Science may be regarded as a disciplined form of human curiosity.

Lead students to develop conservation concepts . . . A concept is defined as an abstraction that applies to a class or group of objects which



have certain qualities in common. Discovering, hypothesizing, and verifying are activities in which everyone participates in daily life. The use of the concepts that result from these processes develops in students a growing awareness of themselves, and encourages them to want to "find out about things". The concepts and degrees of understanding of the concepts depend upon the student's past experiences and the information accumulated as he interacts with his environments.

Make the outdoor experience a happy one . . .

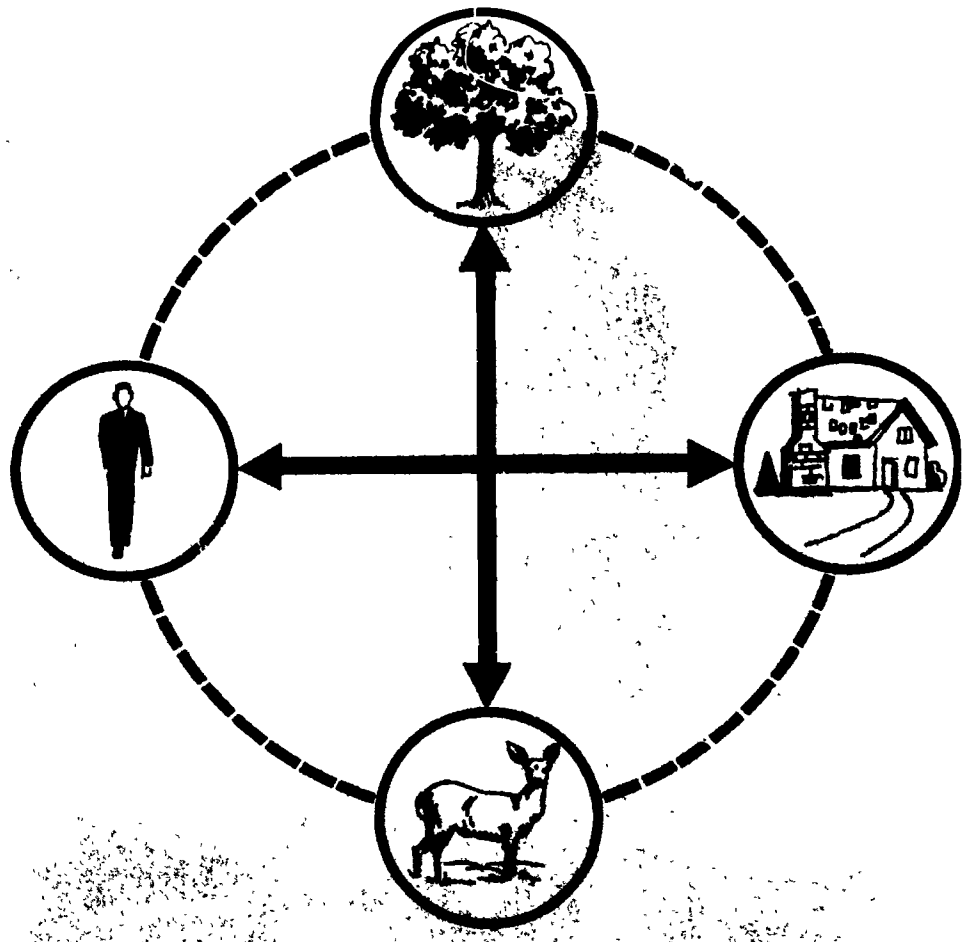
If we had only one objective, this should be it. Any experience for a child, but especially one of learning, is spoiled if it is unhappy. This is true if it is one's class, a school day, a field trip, or a recess. If we cannot make it a happy occasion we have failed.

It may be just another field trip to you. But it may be the child's first one. Furthermore, it may be the only field trip he or she may ever take. Make it a happy—a memorable—occasion. There will be times when he will recount the happiest events of the year. Will he include "that trip" to the National Forest? It should be one of the highlights.

One of the surest ways of making the outdoor experience an unhappy one is to stifle enthusiasm. One way of doing it is to use a lot of "Don'ts." Don't do this, don't do that, don't pick anything, don't step on that, don't go there, don't run, don't shout, don't—don't—don't. Enough don'ts in the soup soon make it unpalatable. However, informality does not necessarily mean complete relaxation of discipline. This points up the importance of the respect, mentioned above, that comes with the development of proper attitudes and a real conservation philosophy. Teach by example. If a child sees you carefully cupping a wildflower in your hand to better show it to him, it isn't likely he will deliberately step on it afterwards.

The development of a program such as that outlined assumes that the local instructional program will:

- Develop the theme that all things are interrelated (people, social institutions, resources).
- Emphasize the fact that our basic needs in food, clothing, and shelter come from our natural resource base.
- Take an ecological approach to principles of conservation as applied to flora and fauna.
- Note the exhaustibility or inexhaustibility of certain basic resources.
- Convey ideas concerning renewability and nonrenewability of resources to the pupils.
- Point out the economics of wise resource management, especially that good conservation means better standards of living.
- Note that a good conservation program leads to better health and recreation.
- Emphasize the possible consequences of resource depletion.
- Make note of the principles of multiple use and sustained yield.
- Welcome more opportunities to provide conservation experiences.



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Accessibility . . . For all practical purposes an outdoor education area must be accessible. With modern transportation facilities, particularly those provided for school children, the site should be located within a 75-mile radius of the school center. Longer distances involve additional stopping and are otherwise too time-consuming.

Where it is possible, the site should be located within walking distance (1 mile or under) of the school center. This makes it possible to start the learning experience at the school door and continue it all the way to the site and back. The closer the site is to the schools the more it will be used.

Access roads must be safe, and should be all-weather roads. School buses generally are not built to travel over roads designed for logging trucks. While a forest may incorporate some unique geographical features, their proximity to the study area need not be the determining factor in its location.

Size . . . An outdoor education a. . need not be large. It must, however, be of adequate size, including contiguous areas, to accommodate the number of people using it at any one time.

Lengths of trails will depend on such factors as terrain, natural attractions, and desired emphasis. Where possible, several trails of various lengths should be developed. Each larger one could be an extension of a shorter one. The first trail should require 45 minutes to an hour to cover. The next larger one might add another half mile loop or half an hour's walk. Preferably it would incorporate some unique features not found on the shorter trail, such as a lakeshore or stretch of stream. A third and even longer trail could include other features such as a waterfall, or a complete trip around a lake.

Where distinctive features lie in opposite directions, it may be desirable to lay out several separate trails, leaving the choice up to the users. This also encourages repeat visits for the purpose of enjoying the entire layout.

Acreagewise, we must be governed by availability. A man can spend a lifetime learning everything there is to learn on 1 acre. We suggest a desirable minimum for our purposes to be 10 acres.

Attractiveness . . . The site should provide an abundance of natural resources and a varied topog. aphy to enrich the outdoor learning experience. It should be located in a place where the users would "like to go anyway". Examples of desirable natural re-

sources and attractions on a site include mixed timber types, varieties of plant and animal life native to the area, fields, hedgerows, ponds, streams, swamps, marshes, deserts, dunes, lakes, seashores, hills, and mountains.

The attractiveness of the area depends also on the comfort the visitors can enjoy while there. There should be adequate shade. There should be a minimum of dust. Insect control measures may be necessary. These are helpful in the learning process, for they prevent such unnecessary distractions as frequent logging trucks raising a pall of dust over the study area, or mosquitoes or deer flies spoiling the day by staging their own picnic.

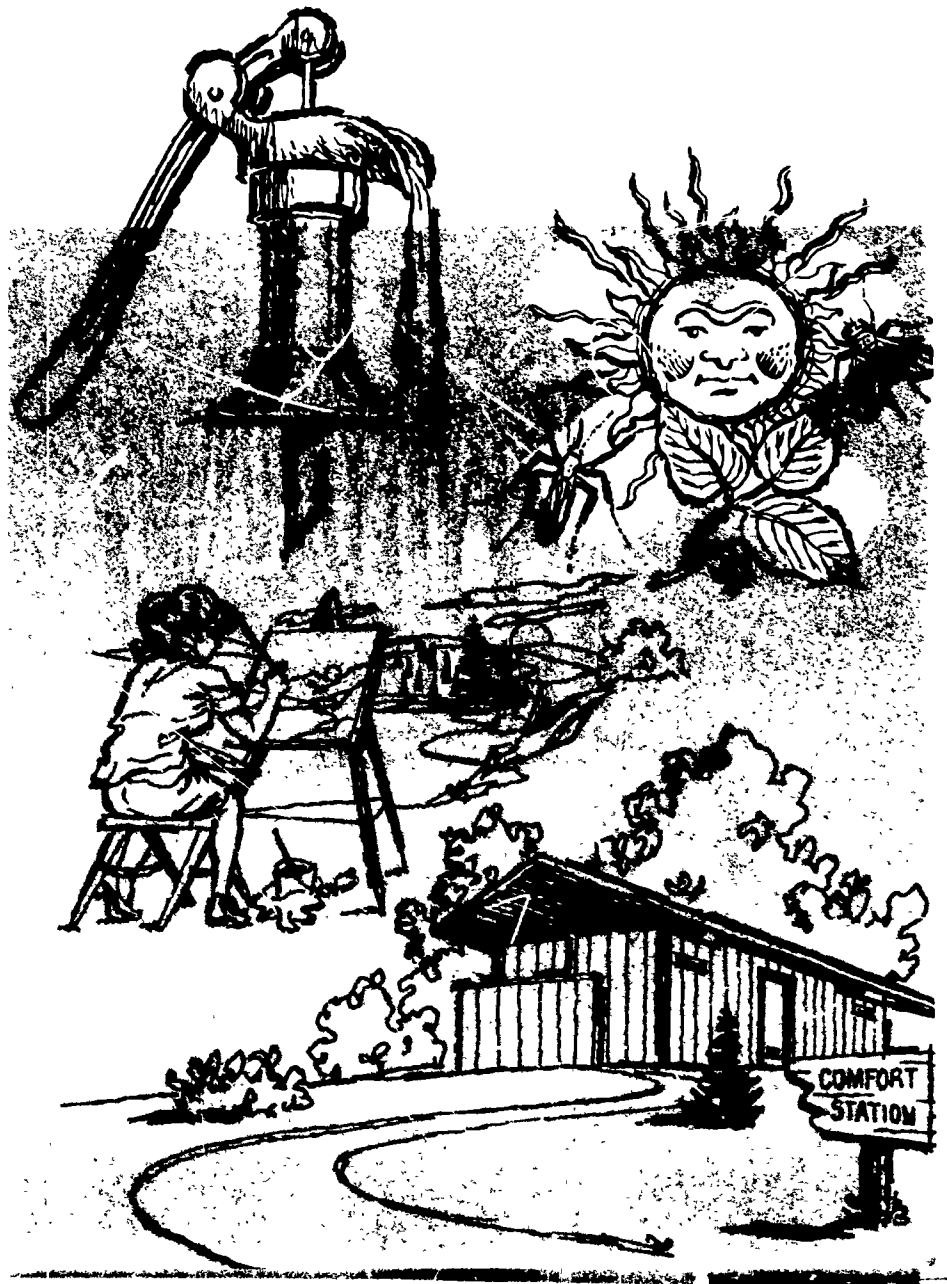
Safety . . . The area should be free from natural hazards, such as unprotected cliffs, pits, treacherous waters, poisonous plants, poisonous snakes, dangerous snags and dead limbs, quicksand and sink holes.

The area should be situated far enough from a public thoroughfare to eliminate traffic hazards. Even along "back roads" one should always be alert to a possible car or truck, especially when a group is present.

All precautions should be taken to eliminate possible contact with dangerous wild or domestic animals. A mean bull chasing someone up a tree is funny only in the comics.

Drinking water . . . The site should have an adequate source of potable water. Otherwise, groups or individuals will have to carry their own supply. Fortunate is the area which can boast a spring or stream of proven purity. In some respects a good well is even better. It is less susceptible to contamination and heavy use cannot muddy the water. Wells are also usually more dependable. It should be kept in mind that a clear running stream is not necessarily fit for drinking purposes.

Sanitary facilities . . . The site must be adaptable to the development of sanitary facilities that comply with all local, county, and State sanitation laws. Toilets may not be the only structures to appear on the site, but they should be the first. Reasonable facilities to dispose of garbage and litter are needed.



Trails . . . The site should include, but not be limited to, an interpretive nature trail. By this we mean a miscellaneous trail.

The old type of nature trail is concerned only with identification, not interpretation. Along such a trail, plants and other natural features are labeled with their common and scientific names and distinguishing characteristics. Such a trail serves the specific purpose of providing an opportunity for study by professional and amateur naturalists.

The miscellaneous or interpretive trail does more than the old type of nature trail. In addition to identifying specimens, it interprets a variety of features. There is a danger in tending to interpret the obvious, which often tells about subjects common to many places. This can become repetitious of other areas and disappointing to visitors who have previously walked similar trails.

We recommend that the trail *identify, interpret, and show relationships* in the total environment. We should still refer to this part of the site simply as the Nature Trail.

A very effective type of trail is one which tells a story or develops a theme. A story or theme gives a trail unity and coherence which help the visitor remember more of the interpretation. However, most trails of this type are associated with some unique feature of the area, either natural or man-made.

A question that arises when developing the nature trail is whether it should be self-guiding, or guided, or both. There is no reason why it cannot be both. A trail used largely by classes, under the guidance of a teacher or some other interpreter, does not require an interpretive booklet or leaflet. The same trail can be interpreted through comprehensive signs, handouts, or even booklets, for those who wish to "go it alone", or do not have the opportunity to go with a class or guide.

The advantage of a self-guiding trail is that it does not require the presence and expense of an interpreter. Visitors may walk the trail when they wish and at their own pace, and may receive as much or as little of the interpretation as they want.

Disadvantages of a self-guiding trail include the danger of running out of the interpretive leaflets, without which the average person would get little information along the trail. Careless discarding of leaflets may cause a litter problem. This problem is averted when all interpretation is done through signs. Signs, however, when they get into much detail, become quite expensive, large, and difficult to construct.

Signs . . . On the kind of trail we prescribe here it is well to have two types of signs: (1) Labels and (2) station signs.

Labels are primarily for identification and may have on them only the common and scientific names of

ees, shrubs, vines, wildflowers, and other plants. Labels are an important part of any nature trail and make it much more interesting for the professional user as well as the student.

Labels should be of a permanent type, such as metal strip markers (preferably aluminum) with embossed or raised letters. Those identifying trees may be fastened directly to the tree without injuring it.

Identification of annuals and perennials is recommended. For this, stakes can be used to hold either metal or plastic markers. These can be moved from year to year or during the season, if a plant dies or a better specimen is found. One need not be concerned about duplications, especially in identifying trees. It takes most students several exposures to really learn a species. This also serves to point out species variations and individual differences.

It is well to have an occasional covered label so the student can first try to identify the species, which he has seen earlier on the trail, and then lift the cover to see if he is correct.

The amount of labeling and exhibiting along trails should be limited and the methods used should be effective and unobtrusive. Good taste and good judgement are the best guides.

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Station signs may also identify a species but usually carry more detail, point out something particularly significant, and are usually numbered. If there is a written guide for the trail, it is customarily keyed to these numbered stations.

Ideally, a nature trail has a series of stations plus interspersed, identified, and labeled specimens. If there is no accompanying written guide, station signs may have to be quite comprehensive. If a guide is usually present, he can elaborate on the significance of the station, and the sign can be correspondingly simple.

Interpretation on a self-guiding trail can be done entirely through the text on signs displayed at each chosen feature. This method is practical because it is fairly inexpensive and the rest of the interpretation is not disrupted when signs are changed, new ones added, or out-of-date signs removed. This flexibility is especially valuable when a trail is first being developed.

Whether or not to place a sign at a station depends largely on how many extraordinary features it is desirable to point out, how long the trail is, and how much time it is designed to consume. No trail should be cluttered with signs. All interpretive devices on a trail should be meaningful to the most inexperienced visitor but these devices should not intrude too much into the scene.

Simplicity should be the key to such signs. Names, simple outline drawings, and diagrams for identification purposes are in order. Brief labels with short, concise language pointing out natural relationships are occasionally acceptable, but complicated relationships and fully developed ideas are best reserved for guide booklets or for exhibits.

Entrance signs, directional signs, and other general information signs do not fall in this interpretive category. They usually evolve from necessity and are developed at the planner's discretion.

An excellent trail can be developed in half a mile, with 12 to 18 good stations, well interpreted, and significant species identified and properly labeled along the way (see page 12 for Examples of Stations).

Zoning may be employed in developing the trail so that greater emphasis can be given to distinctive features. This again depends on the length of the trail and the incidence of such features.

Such zoning may be confined to the main trail, or may incorporate side loops. Side attractions should bear such designations as geology loop, wildlife loop, soils loop, or pond habitat.

It may be that the area is accessible enough so that separate trips can be made to study each zone. Some tours are divided into two parts or two trips; the first for identification of trees, other plants, and other things in the forest; and the second for ecology, or the discussion of basic interrelationships observable in the life of the forest.

Special Areas . . . The cultivation of curiosity should be a prime purpose of the nature trail. This is enhanced by a trail which is both winding and secluded. Not being able to see what is around the next bend increases anticipation. It also makes it easier for the guide to keep attention focused on the subject at hand.

Interconnecting trails that allow a choice of walking time and study situations add variety and interest to an area.

The trail may lead through areas of special interest (erosion, plant succession, a burn) small enough to become stations. On the other hand, such special areas may be extensive enough to be set aside for separate study (see zoning above). These separate areas should be separately identified and so indicated on the map, if there is one, and in the written guide. Certain special areas may be extensive or important enough to warrant their own writeup or booklet. This points up the chief distinction between "special areas" and "stations". Stations are stops in the main trail and are interpreted by special signs or by the printed guide. Special areas may call for their own trail, loop, or section of the main trail (zone).

Natural	Manmade	Natural	Manmade
Fire damage	Fence wire imbedded in a tree	Burn	Timber management
Animal damage (Porcupine, sapsucker, bear)	Witness tree	Geology	Timber sale
Lightning tree	Bench mark	Wildlife habitat	Forestry demonstration plot
Decayed log or stump	Dump	Lake	Silviculture
Den tree	Hedge	Stream	Timber harvest
Woodpecker nesting tree	Stone or rail fence	Pond habitat	Farm woodlot management
Unusually large tree	Dam	Marsh	Recreation area
Unusual rock formation	Weir	Swamp	Dam site
Spring	Retaining wall	Desert	Game management area
Small stream	Road cut	Sagebrush habitat	Reservoir
A lichen station	Borrow pit	Plant succession	Nursery
An active burrow	Small pond	Soils	Plantation
Bee tree	Tapped maple	Watershed study area	Maple sugar camp
Beaver work	Hacked pine (turpentine face)	Water hole	Logging camp
Natural exposure soil profile	Bird bath	Tidal flats	Farm
Gully	Feeding station		
Fungus growth	Resting place (bench, council ring, etc.)		
Uprooted tree	Footbridge		
Unusual or large vine	Historical landmark		
Natural reproduction	Picnic table		
Hornet's nest	Evidence of logging activity		
Squirrel nest	Sawlog		
Glen or ravine	Cord of wood		
Mound (may be man-made)	Measuring tree		
Scenic view	Weather station		

Black walnut (Juglans nigra) . . . This is one of our most valuable trees. Its wood is in great demand for use in furniture, gunstocks, and interior finishings. Single trees have sold recently for as much as $1,000. They also bear delicious nuts. A fast growing hardwood, black walnut sometimes grows to be 150 feet high and 6 feet in diameter.

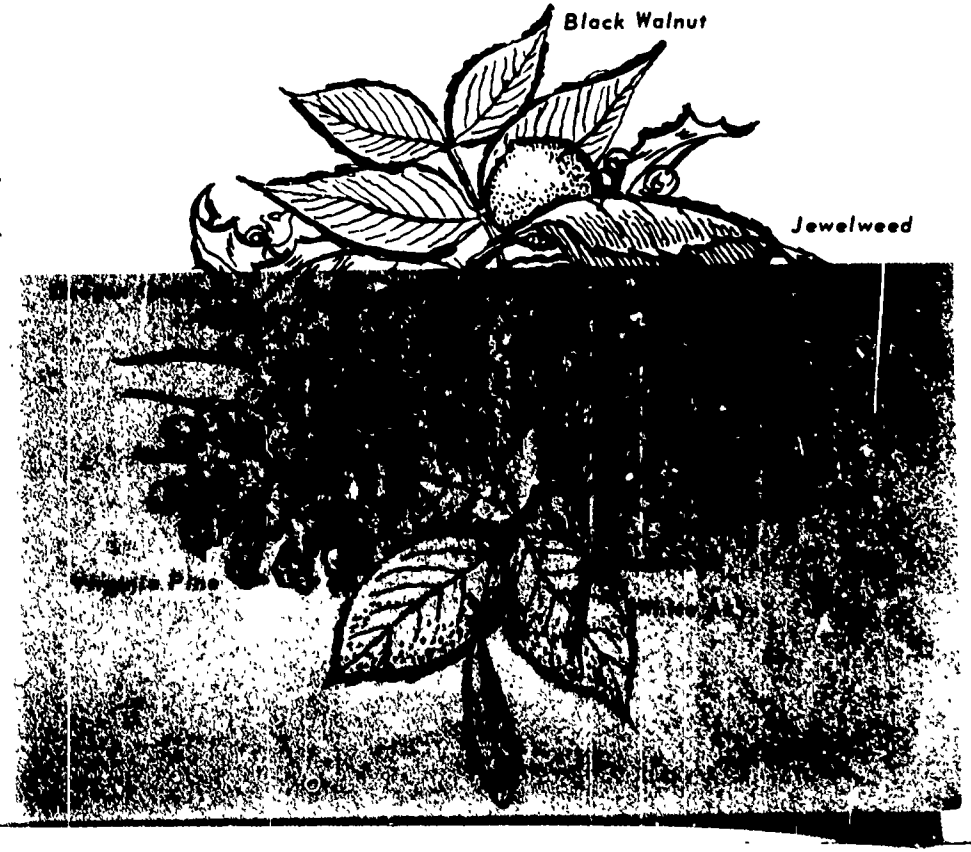
Virginia pine (Pinus virginiana) . . . This pine seldom grows over 50 feet high, and matures in 100 to 150 years. The needles are from ½ inch to 3 inches in length, and usually in pairs. The 2-inch cones are reddish brown, shiny, and prickly, and grow tight to the stem. In recent years this species has become important for pulpwood. The wood is also used for lumber and fuel. Perhaps the tree's greatest value is in reforesting waste lands, for it seeds and does well in poor soil.

Oregon grape (Mahonia aquifolium) . . . This plant has holly-like leaves, bright yellow flowers and is used by florists. The fruit makes good jam and is eaten by birds, squirrels, and chipmunks. It is Oregon's State flower.

White ash (Fraxinus americana) . . . This tree is usually large and well shaped, and is one of the leading commercial hardwoods of the United States. The hard, close-grained, light brown wood is strong, tough, elastic, and free from taste or odor. It is most famous for its use in baseball bats and tool handles, but it is also used for oars, furniture, interior trim, boxes, railroad ties, veneer, and fuel. Clusters of paddle-shaped fruits 1″ to 2″ long often hang on the trees all winter.

Jewelweed (Impatiens biflora) . . . Jewelweed grows in moist places, along streams and around ponds and lakeshores. If you hold a leaf of this plant under water you will see why it has this name. In the late summer look for the orange flowers and seed pods which open at the slightest touch.

Mayapple (Podophyllum peltatum) . . . Mayapples grow in colonies and sprout from long, thick underground stems. They bloom the last half of May. The single, white, bell-shaped flower is often hidden under the broad leaves. The lemon-yellow fruit, when fully ripened in the summer, is edible but very laxative and should not be considered as food. All other parts of the plant are poisonous.



Fire Damage . . . Note the large scar at the base of this tree. Foresters and loggers call this a "cat face". It was undoubtedly caused by fire some years ago. How do we know it was some time ago? For one thing, there is no longer evidence of the blackened or charred area, which sometimes can be seen for years. Also, t tree has grown considerably since the damage was done. Why did it not kill the tree? If the damage had gone all the way around the tree it probably would have killed it. The inner part of the trunk, which looks dead, is the heartwood. Actually, it is dead—in all trees. The heartwood, often much darker than the sapwood, is important to the tree in that it adds stiffness and support to the trunk. But a tree can live without it. You have undoubtedly seen completely hollow trees which are very much alive. However, it is to the outside of the sapwood that the living layer of cells, called the cambium layer, adds growth every year. Do you think this scar will be eventually completely covered? Perhaps. Or, the heartwood may rot out and the tree become hollow for the rest of its life. Then it would make a good home for animals. But it also lets in insects and disease. Such a tree is more easily blown down by the wind than a sound one. And, of course, the damaged or rotted part is a waste if the tree is cut for lumber. This is one of the costs we often do not think of in connection with forest fire. While a fire may not kill a tree, it makes it much less valuable. And this happens to thousands of trees in a forest fire. So, remember—be careful with fire!

Fence wire imbedded in a tree . . . Here is another phenomenon involving the growth of a tree. No doubt, many years ago some farmer fastened this fence wire to this tree conveniently growing at the edge of his field. This was one place he did not have to set a fence post, for he had a live one. Did it injure the tree? Not very much, although it did make it grow rough and warty. Why didn't the wire move up higher as the tree grew? We know the tree grew for many years and is still growing. It covered the wire and staples, until now they are in the very center of the tree. Have you figured out why they are no higher off the ground than when the farmer put them there 30 or 40 years ago? Remember, a tree trunk grows in diameter only. That is how it gets bigger around. The other place a tree grows is at the end of the twigs and branches. That is how it gets taller.

Bare-rock succession . . . The changing of biotic communities is called *succession*. This process is going on continually. One such succession may be seen here. It is a very important one—for this is one way our soils are formed, and our soils of course, are the very foundations of life on earth.

The first community to appear on bare rock is some crustose lichen. The lichens, which next include successively, foliose and fruiticose lichens, produce acids that gradually make crevices in the rock surface. Small quantities of the decaying lichens and bits of dust, blown by the wind, collect in these crevices. Thus a simple soil is formed. And water no longer runs off so quickly. Mosses soon arrive, and seeds of larger plants germinate in the accumulating soil—grasses and other annuals, and eventually shrubs and trees. In many places, succession continues until a forest community develops, though the process may require hundreds of years.

Demonstration plot . . . This ¼-acre demonstration plot has been set aside to help you learn something about forestry and conservation in a practical way, and to help you understand the relationship between conservation and economics.

A forest is basically a collection of trees. It is a living community of plants and animals in which trees are the dominant species. Forests are among our greatest natural resources. They provide not only wood, but water, wildlife, forage, and recreation.

Wood is vital to our national security, our economic strength, and our well being. More than 5,000 products in everyday use come from the forest.

Fortunately, forests are a renewable resource. That is, by applying the principles of good forestry we can use our forests and still always have them. This is wise management. If we are to have it—if we are to practice conservation—people must understand and be concerned about the forests, and develop proper attitudes and habits regarding them.

Since forests may be very large (this *forest* contains ___ _ acres), we are taking a look at a small area. The center of this circular ¼-acre plot is a steel stake your guide will show you. The perimeter of the circle is 59 feet away from the center.

This is a typical forest area for this region and elevation. Notice the kinds of trees we have here. Most of them are hardwoods (deciduous), but there are also some conifers (evergreens) present.

There has been no recent harvesting done on this plot, but by marking and identifying individual trees it is possible to show you something of how such a forest could be harvested and managed so that it will not only be improved but will always be growing here. In considering the management of a forest, one of the first things a forester must know is, what does the owner wish to get out of this resource? In this case, you are one of the owners, for the National Forests belong to the American people.

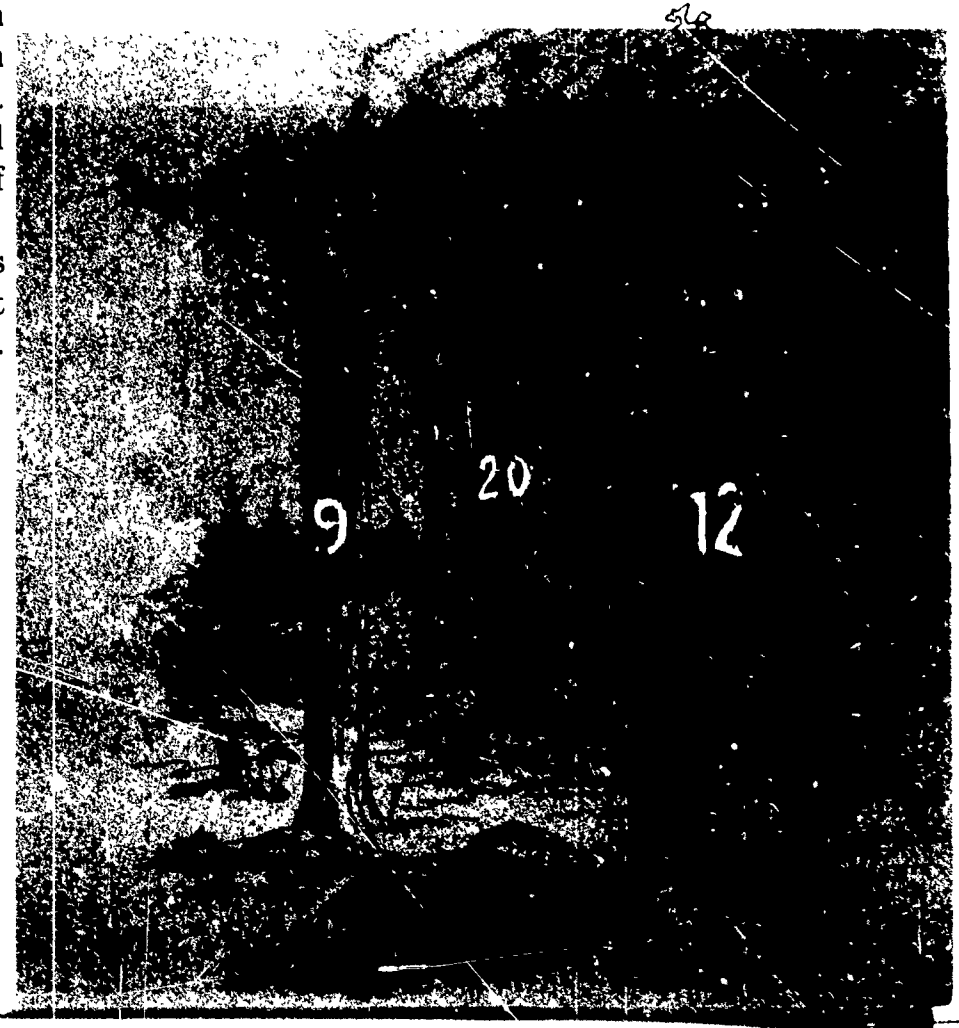
If the owner wants to convert the trees into all the money he can get immediately, of course, he would harvest them all at once. If he wants to harvest only that which is produced each year, he can do this and still keep his growing stock, and his forest will always be there. This is known as cutting on a "sustained-yield" basis. Or, he can decide not to harvest any of the timber, but let the trees reproduce, grow, die, fall down, and decay as they will. This, of course, will produce nothing in the way of timber products. Death and decay will exactly offset growth, and, as in any virgin forest, the "annual increment" (annual growth or gain) is zero. It is true that the forest will still provide recreational and esthetic values and will protect the watershed. But, if all forests were closed to harvest, where would all the forest products we use come from?

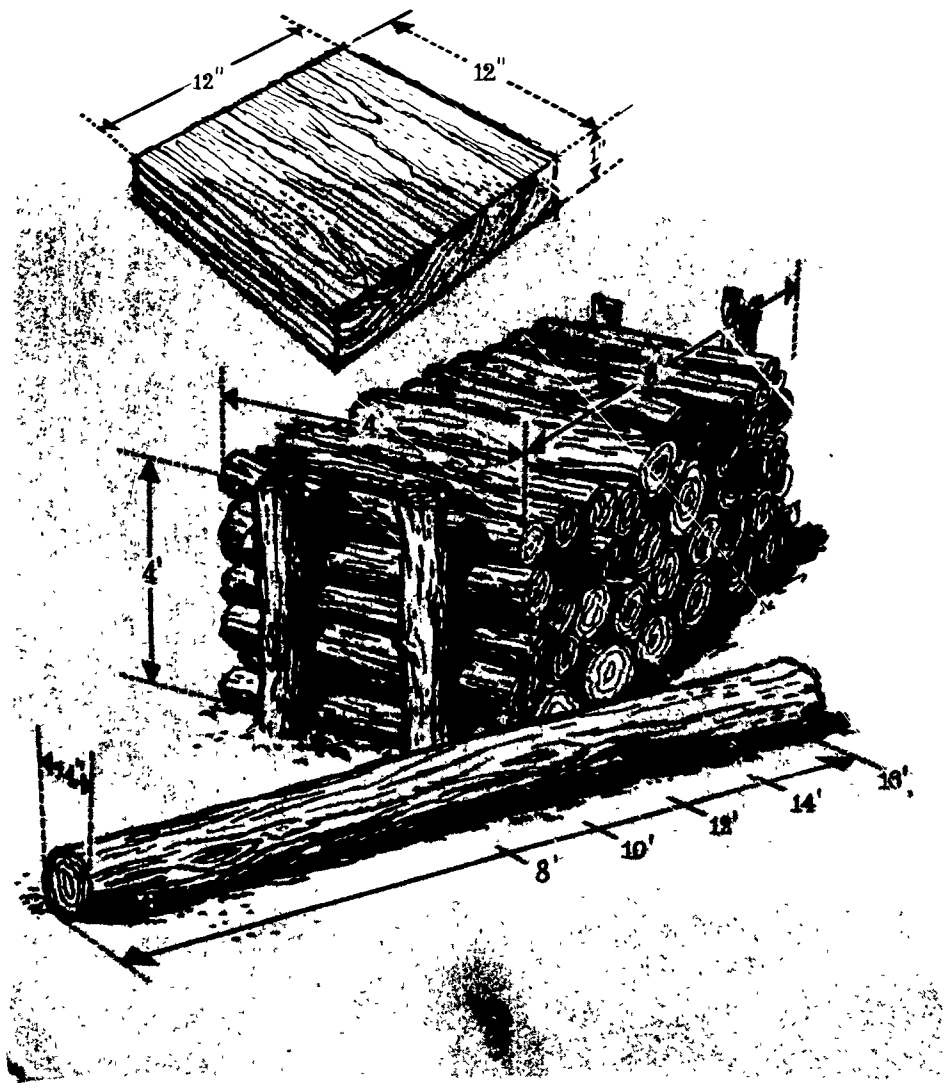
Let us look then at what we may expect to get from this kind of forest if it is managed on a "sustained-yield" basis. Remember, such management will not interfere with the other benefits of the forest.

In harvesting we would cut no trees smaller than 10 inches in diameter. We have numbered 22 such trees on this ¼-acre. You will want to refer to the list of trees of "commercial size" which also gives a description of each species.

There will be an average of 88 such trees per acre in this part of the forest. Their yield each year will be about ½ cord of wood, or approximately 250 board feet of lumber (NOTE: *it is well to have a measured cord of wood and a measurable sawlog on or near the demonstration plot*). This much could be harvested each year on every acre in such a forest and the forest would still always be here. Also, by carefully selecting the trees to be cut and removing inferior and mature trees, the quality of the forest would be improved.

If all the merchantable trees on an acre such as this were harvested at once they would yield about 40 cords or 10,000 to 15,000 board feet of lumber.





(NOTE: *It may be desirable to estimate various potential yields in monetary terms, per various acreages and per year and/or total harvest*).

(Simplified instructions on how to measure a log and a tree should be introduced at this point if not sooner. If a writeup is used for this special area certain definitions (board foot, cord) should be included. Also, it would be well to include a sample log rule, volume table, etc.) (NOTE: *All figures should be varied to fit your particular area.*)

Now You Do Some Looking

We have used some terms and units of measure which may be new or unfamiliar to you. Here is your chance to become better acquainted.

Board Foot: A board foot is a unit of measure equal to a piece of wood 1 inch thick and 12 by 12 inches square.

Cord: A cord is a unit of measure equal to a pile of wood containing 128 cubic feet. That is, a pile 4 feet by 4 feet by 8 feet, like the one we have here. If the wood is cut in 2-foot lengths, the pile would need to be 16 feet long. A pile of wood can have any measurements and equal a cord so long as the three dimensions equal 128 cubic feet when multiplied together. Most pulpwood is sold by the cord.

Measuring a Log: We need two measurements to find out how many board feet are in a log—diameter (small end, inside bark) and length. Diameter is measured to the nearest full inch. When a log is not round an average of the smallest and largest diameters is taken.

Logs are usually cut in lengths which are multiples of 2 feet—8, 10, 12, 14, or 16 feet.

After the diameter and length of a log have been obtained, and no deductions are to be made for defects, the contents can be found in the proper log rule.

Now, let us look at certain individual trees and try to decide if a forester would mark them for harvest or not, and if so, what would they yield.

Geology Trail

You will note from the map sign on the main trail that we are now beginning what we call the Geology Loop Trail. It is approximately ¼-mile long and if you stay on it you will come back into the main trail near the bridge. This trail follows along at the base of the cliff, between the cliff and the river.

We are very fortunate in so short a trail to find excellent examples of all three great groups of rocks—Igneous, Sedimentary, and Metamorphic rocks. A rock may be defined as a substance composed of one or more minerals.

• Igneous Rock

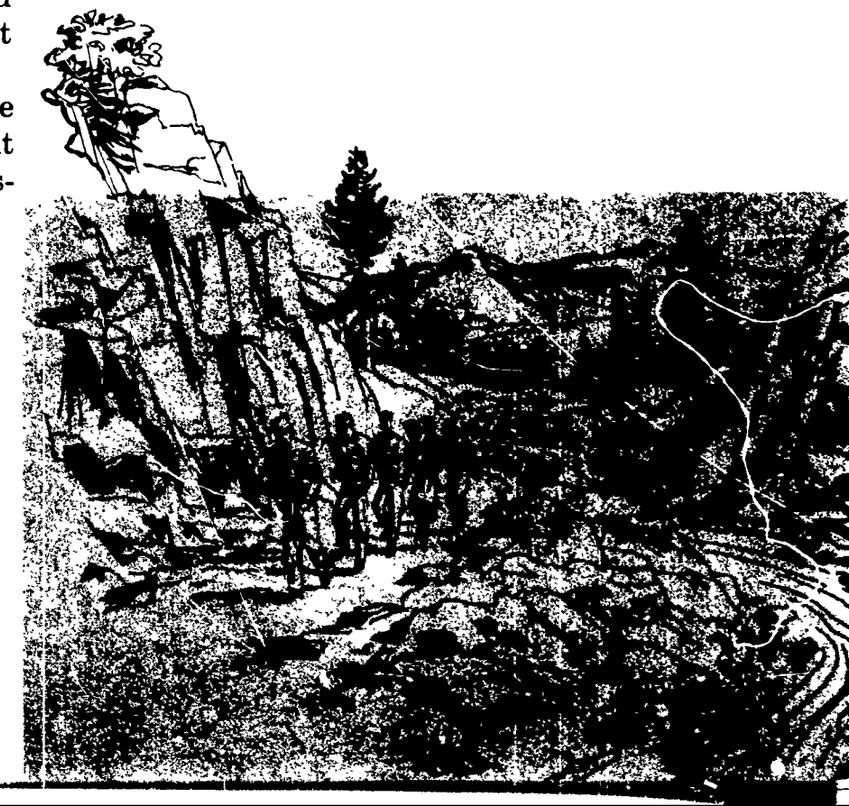
In these granite boulders strewn along the river bank we have good examples of one kind of igneous rock. Igneous rocks are those which resulted from the solidification of molten substances deep in the earth. They are the first, or primary rocks. They might have been brought to the surface originally by volcanic action. Some might have been carried here by glaciers. And some, especially among the smaller ones, have been worn smooth by the action of water over the ages.

Other examples of igneous rock which are found on this trail include basalt and diorite. They are labelled at several places near the path.

• Sedimentary Rock

This entire cliff is composed basically of limestone, a sedimentary rock. The word "sedimentary" is applied to a group of rocks because during their formation the materials composing them settled to the bottom of a body of water. These limestone layers probably were laid down while this area was covered by one or more of the shallow seas which occurred between the ice ages and periods of glaciation. When first deposited the material was mud or clay. Tremendous pressure and heat, plus a lot of time, caused the transformation.

In at least two places along the trail there are exposed layers in the limestone containing ancient fossils. These are the petrified remains, or impres-



sions of such remains, of creatures and plants that lived in the seas mentioned above, and which, for the most part, are now extinct. For example, numerous sharks teeth, from species no longer in existence, have been found in these outcroppings.

There are many different kinds of sedimentary rocks. Among the most abundant are shales, sandstones, limestones, chalk, and dolomites.

- **Metamorphic Rock**

"Metamorphic" means "changed in form". So, metamorphic rocks are rocks formed from other rocks, possibly like some we have been studying. At least, they are formed from pre-existing rocks, either igneous or sedimentary. In their formation, various agents worked on the materials—water, gases, heat, and pressure.

After many ages of being subjected to the activity of such agents, the rocks appeared in a new form to cool and harden into something we can now examine.

This is a schist, and from some of the materials in it granite was apparently one of the chief igneous contributors. A little further along we will find some slate (clearly marked) which is metamorphosed from shale. Marble, which we do not have here, is a common building stone, derived from limestone. In other words, if the rocks of this cliff were to undergo the same tremendous changes of heat and pressure which this schist has undergone, the rocks would come out as marble.

Some of the other rocks have fallen from the top of the cliff and some have been rolled here by the river. So we have quite a variety to examine. Some were carried here by glaciers which ground and rolled and crushed them. This accounts for much of the gravel found at the base of the cliff near the bridge.

Physical and Historical Geology

Geology isn't all rocks, however. There are two major subdivisions of Geology—Physical Geology and Historical Geology. As you might expect, physical geology has to do with the makeup of the

crust of the earth, and forces modifying it. Historical geology has to do with the history of the earth from the earliest time to the present. These fossil beds fall into the latter category.

An important physical geology feature here is the river and the evidence of its work. We are standing on the flood-plain. Flood-plains are formed by deposits made by a stream. A stream acts two ways—it wears down the land and it also builds up the land. Flood-plain deposits may vary from a few inches to 50 feet in thickness, and they occupy the entire width of valley bottoms, except where the stream cuts through to solid rock. Flood-plain deposits are among the richest soils and are the most cultivated all over the world. You can usually tell where the fairly level flood-plain ends at the sides of the valley, and the ground begins to rise more sharply.

As we look up this valley, we can see that it has a wide U-shape. This indicates that this river did not cut this valley all alone. This is a glacier-formed valley. Valleys cut by streams alone are more V-shaped. This river may have cut a valley here before the glaciers, just as it is cutting now, but we are quite certain a glacier or glaciers modified the valley.

Developing a good inventory of an area selected for outdoor education purposes is of utmost importance. This would include all resources such as types of soil, timber, plants, animals, special geological features, etc. It would also give a brief history of the area, including past uses of the land and its resources.

It is also recommended that a guide to the general area be developed which has maps of the area, pertinent information and photographs, suggested activities, projects, and further sources of information or materials. This would be in addition to written guides for special areas (see page 11, "Special Areas").

The general guide to the area may be made available to schools and groups before they arrive, while on the area, and to keep for follow-up work when the visitors return to their school or elsewhere.

Outdoor education area developers should draw upon all technical assistance available. Where possible, teachers and schools, scientists, administrators, and instructors should be consulted and brought in to provide the kind of cooperation in such projects that will help insure their quality and maximal use.

To realize full utilization and provide maximum opportunity for living experiences, the outdoor education areas should be designed to accomodate various levels of learning as well as all age groups.

Conservation education is so broad in scope and covers so many subjects and interests that any outdoor classroom must serve multiple purposes. Such uses can be completely compatible.

It is well recognized that maturity plays a significant role in learning. Approaching the student "where he is" is of utmost importance. For instance, it would be a serious mistake to try to interest a six-year-old in the problems presented by the increasing demands on our natural resources, but we can use his interest in birds and other animals to help him understand how they affect, and are affected by, man.

A special area, for example, might be developed by agronomists for the primary purpose of soils studies. This could well be at the college level. There is no reason, however, why the same area cannot serve at the same time as a place for third graders to find different "kinds" of rocks or learn identified plants along the trail. Any activity which might disturb an academic study could easily be avoided.

The same area might supply a new "find" for the rock-hound, a rare reptile for the herpetologist, or just a pleasant walk for a family outing.

When the time comes to evaluate the outdoor education aspects of our entire environmental education program, multiple assessments will be applied, ranging all the way from curriculum enrichment and improved social behavior to renewed interest and enjoyment by persons of all ages.

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For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington D.C. 20402 Price 20 cents

"What a man hears, he may doubt,
What a man sees, he may possibly doubt,
What a man does himself, he cannot doubt."

S. A. Knapp